IS 8824-2 (1988): Electrical moisture meters, Part 2: For jute (conductivity type) [ETD 18: Industrial Process Measurement and Control]

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(Reaffirmed 2005)

Indian Standard

SPECIFICATION FOR ELECTRICAL MOISTURE METERS

PART 2 FOR JUTE (CONDUCTIVITY TYPE)

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

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Indian Standard

SPECIFICATION FOR ELECTRICAL MOISTURE METERS

PART 2 FOR JUTE (CONDUCTIVITY TYPE)

0. FOREWORD

0.1 This Indian Standard (Part 2) was adopted by the Bureau of Indian Standards on 13 July 1988, after the draft finalized by the Industrial Process Measurement and Control Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard (Part 2) specifies requirements for electrical moisture meters, used for the determination of moisture content of jute, while IS 8824 (Part 1) : 1978* specifies requirements of moisture meters for foodgrains.

0.3 Moisture meters for jute operate on the principle of measuring the electrical conductivity of jute. The electrical resistance of dry jute is high (of the order of 10^{12} ohms for the mass of fibres held in contact with the electrode used). The value falls to 10^{4} ohms when the moisture regain is 35 percent or above.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Specification for electrical moisture meters: Part 1 For foodgrains.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard (Part 2) specifies the requirements and tests for battery - operated electrical moisture meters used for the determination of moisture content of jute.

2. TYPES

2.1 The electrical moisture meters for jute shall be of conductivity meters type only.

3. OPERATING PRINCIPLES

3.1 General — This meter works on the principle that electrical conductivity of the material under test is proportional to the amount of moisture contained in it. Moisture is determined by the measurement of electrical resistance of the sample of jute.

3.1.1 The usual practice of determining the moisture in the raw jute bales is to open a few bales and test a few *morahs* with the moisture meter. The practice is time consuming and if the bales are not consumed directly, the opened bales will have to be rebaled for storage.

The recent development of long spiked electrode used with the moisture meter enables direct measurement of moisture of raw jute bales without opening the bales.

3.2 Conductivity Meters — The basic electrical circuit diagram of the instrument is shown in Fig. 1. E is the emf of the battery, R a known fixed resistance, E', the drop of voltage and R', the variable resistance of the fibres to be measured. From the relation $R = (E/E' - 1) R'$, R' can be determined by measuring E'. Since the resistance of the fibres varies over a wide range with variations in measuring R with maximum accuracy, it is, therefore, necessary to ascertain beforehand the actual range of variation in the resistance of the fibres R at different moisture contents so that the corresponding order of resistance (R') to be included in the circuit may be known. For this purpose, the following method has been used.

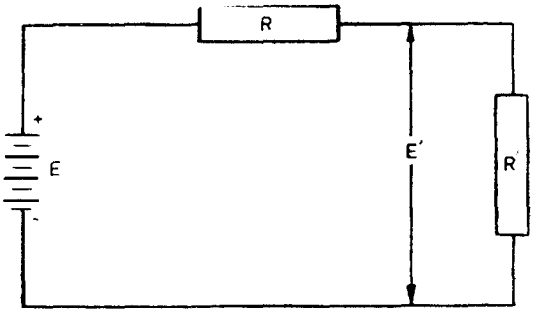

FIG. 1 BASIC ELECTRICAL DIAGRAM OF THE INSTRUMENT

3.3 Measurement — A strand of jute fibre is tied at both ends with copper wires which project into a glass cylinder through holes in the rubber corks. Air, conditioned at a given humidity, is circulated round the fibres and the electrical resistance of the conditioned fibres is measured using a commercial type of moisture detector which is, in principle, the device for comparing different high resistances. The detector readings are at first calibrated against different known resistances and then used for measuring the resistance of the jute strand.

3.4 At least 3 different values of R' will be necessary to cover the complete range of variation of the resistance of the fibres with moisture content. The design of the instrument is connected with the problem of measuring accurately the voltage (E) appearing across resistances of high values (R'). From the principle of voltage measurement across a high resistance, it follows that the measuring device should have a high internal resistance and the condition is satisfied by a high input device.

3.5 Effect of Pressure of Contact — A pressure control device shall be incorporated in the electrode so that there is no appreciable affect on the meter readings due to the variation in the pressure of contact between the electrode and the fibre. But the orientation of the electrode with respect to the length of the *morah* has the effect in as much as the reading is slightly higher when it is placed at right angles instead of along the length of the *morah*.

4. CONSTRUCTIONAL FEATURES

4.1 General Description — The instrument consists mainly of two parts : (a) the electrode and (b) the amplifying/recording unit. Electrodes may be of varying design and construction depending on the type of material on the calibrated scale of an indicating meter.

4.2 Power Supply — All the meters shall be powered from standard type dry battery cells. An automatic cut-out device shall be provided on the meter to eliminate unnecessary consumption of battery current when the meter is left without switching off through oversight.

4.3 Electrode — The electrode shall consist essentially of a pair of conducting plates with which the material under test should be in close contact. To ensure uniform contact with the material in repeat tests, a spring-loaded pressure-controlling device is provided inside the electrode so that readings are taken only when a predetermined pressure has been applied to the electrode.

4.3.1 Electrodes may also be of long-spiked type for direct measurement of moisture of raw jute bales without opening the bales (*see* **3.1.1**).

5. GENERAL REQUIREMENTS

5.1 General — Moisture meters shall be sturdy and compact.

5.2 Temperature Compensation — Moisture meters shall have a built in temperature compensation circuit to avoid the error due to temperature change or calibration charts shall be provided along with the meters when temperature compensation is not provided.

5.3 Calibration Check-Up — The moisture meter shall be provided with an arrangement to check up the calibration of the meter as and when desired.

5.4 Scale — Moisture meters shall have a suitably graduated scale to indicate percentage of moisture content directly. Alternatively, calibration charts may be provided.

5.5 Supply Voltage — The meter shall be designed for operation from a dc source not exceeding 45 volts dc.

5.6 Accessories — The required accessories for operating the moisture meter including the compression unit and the electrodes shall be provided along with the meter.

5.7 Carrying Case — The meter shall be provided with a suitable carrying case. It shall also accommodate all the accessories.

6. ACCURACY

6.1 The accuracy of the moisture meters at 27 $\pm$ 2°C shall be declared by the manufacturer.

7. MEASURING RANGE

7.1 The measuring range shall be from 8 to 70 percent of moisture content.

8. OPERATING TEMPERATURE RANGE

8.1 The moisture meter shall be so designed as to perform satisfactorily from 0 to 55°C continuously and at a maximum humidity of 95 percent.

9. OPERATING INSTRUCTIONS

9.1 The manufacturer shall provide all the necessary precautions and operating instructions, preferably on the meter casing.

10. PACKING AND MARKING

10.1 Packing — Moisture meter shall be packed in wooden or other suitable container in which it could conveniently be carried in the field.

10.2 Marking — The scale plate of the moisture meter shall be clearly and indelibly marked with the following information:

a) Manufacturer's name or trade-mark,

b) Type of meter,

c) Accuracy class,

d) Supply voltage, and

e) Country of manufacture.

10.2.1 The moisture meter may also be marked with the Standard Mark.

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

10.3 Information — The manufacturer shall supply a suitable leaflet containing the precautions to be observed in the use of electrical moisture meters.

11. TESTS

11.0 General Conditions for Tests — Unless otherwise specified, all the tests shall be carried out under the following conditions:

Temperature:	15 to 35°C
Relative humidity:	45 to 75 percent
Pressure:	86 to 106 kPa

11.1 Type Tests — The following shall constitute type tests:

a) Insulation resistance test (**11.4**),

b) Calibration test (**11.5**), and

c) Repeatability of error (**11.6**).

11.1.1 *Samples for Type Tests* — Type tests shall be applied to three test specimens; in the event of any one specimen failing to comply with the requirements in any respect, a further set of three specimens shall be taken, all of which shall comply with the requirements of the standard.

11.2 Acceptance Tests — Under consideration.

11.3 Routine Tests — The following shall constitute routine tests:

a) Insulation resistance test (**11.4**), and

b) Calibration test (**11.5**).

11.4 Insulation Resistance Test — The insulation resistance between the two electrodes connected together and the metallic casing (or accessible metal parts connected together, if casing is not wholly metallic), when measured at 500 ± 50 W dc applied for a minimum of one minute shall be not less than 10 megohms.

11.5 Calibration Test — The calibration shall be done in the standard oven. The moisture meter shall be calibrated for a product temperature of 27±2°C and relative humidity of 65±5 percent.

NOTE — At temperatures other than that of the calibration, either correction has to be applied or temperature compensation circuits have to be built in the meter. In case correction is necessary, proper calibration charts may be provided.

11.5.1 *Calibration of the Instrument* — Samples of fibre conditioned at different humidities are tested first with the instrument and then their moisture regains determined by drying in an oven at 105 ± 10°C. As a routine procedure, the electrode is always placed at right angles to the *morah*. The calibration curves for the three ranges, that is, low, medium and high, may be determined.

11.5.2 *Measurement with* Kutcha *Bales* — Three readings for each bale are taken by introducing the electrode successively into the position marked A_1-B_1, A_2-B_2 and A_3-B_3 (*see* Fig. 2). Gentle hammering on the electrodes is necessary to ensure tight contact with fibres. The average of the three readings with the electrodes in the positions marked as in the diagram (*see* Fig. 2) has been found from many preliminary trials to give the representative value of the percent moisture regain of the whole bale.

The bale is now unpacked and sample *morahs* from its different parts are tested with the same instrument using the electrode for loose jute in the manner as described earlier. In all 25 readings of the meter are taken for each bale and the average moisture content is obtained using the appropriate calibration curve.

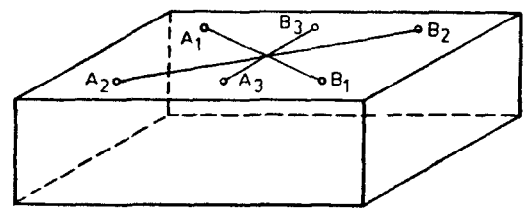

FIG. 2 POSITION OF THE ELECTRODES MARKED ON A JUTE BALE

11.5.3 *Direct Measurement with Long-Spiked Electrodes* — The electrode is forced into the bale at 4 pre-determined positions. At each position, 3 readings are taken at three different depths of penetration, one about 150 mm from the bottom, one approximately at the middle and the third about 150 mm from the top. Thus in all 12 readings are taken. The average of these

12 readings multiplied by 0·9 gives the average moisture in the bale.

11.5.4 *The Error of Measurement* — The error shall not exceed ± 0·5 percent in the low and medium ranges. In the high range, the error shall not exceed ±1 percent.

11.6 Repeatability of Error

11.6.1 The test shall be carried out by calibrated instrument at 3 ranges, that is, low, medium and high. At each range, 6 readings at an interval of 15 minutes shall be taken. Maximum deviation shall not exceed 2 percent of the average reading.

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